UNITED STATES UTILITY PATENT APPLICATION

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FOR

HANDLE ASSEMBLY FOR TOOL

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HANDLE ASSEMBLY FOR TOOL

[0001] The present invention relates to handle assemblies for tools, and relates particularly, but not exclusively, to handle assemblies having combined friction gripping and vibration damping properties, for power tools in which an output shaft is driven by a motor.

[0002] Known power tools, such as power drills in which a drill bit is rotated by an output shaft which is in turn rotated by means of an electric motor, generate significant amounts of vibration, which can under certain circumstances limit the length of time during which the tool can be used continuously, and may even cause injury to users of the tool. In addition, the housing of such tools is generally made from a durable plastics material on which it can be difficult for a user of the tool to maintain a grip when the tool is in use for a sustained period.

[0003] US 6308378 discloses a gripping arrangement for a handle of a power tool in which the sides of the handle are provided with frictional gripping zones, each side of the handle including a plurality of alternating gripping zones of a softer material and a harder material. The softer material used is generally a thermoplastic elastomer or rubber material, and the harder material is generally the same material as that from which the tool housing is formed.

[0004] This known arrangement suffers from the drawback that because the softer material performs the dual functions of providing a friction grip and vibration damping, the choice of material constitutes a compromise in that although it will have acceptable friction reducing and vibration damping properties, the performance of the handle is limited because a material having optimum frictional properties will generally have unacceptable vibration damping properties, and vice versa.

[0005] WO02/38341 discloses a grip handle for a hand-held machine tool in which a hand grip is separated from the remainder of the housing by a vibration damping element consisting of an inflatable annular air filled cushion. An additional handle is provided which has a tubular grip element surrounding a further annular air cushion.

[0006] This known arrangement suffers from the drawback that the use of annular air filled cushions makes the tool of complicated construction, which in turn increases the cost of manufacture of the tool.

[0007] Preferred embodiments of the present invention seek to overcome the above disadvantages of the prior art.

[0008] According to an aspect of the present invention, there is provided a handle assembly for a power tool comprising a housing defining a handle and housing a motor for actuating an output member of the tool, the assembly comprising at least one flexible member adapted to be mounted to a surface of the handle of the power tool and having an engaging portion adapted to be engaged by a hand of a user of the tool, wherein said engaging portion is adapted to retain at least one gaseous vibration damping material between the engaging portion and the surface of the handle.

[0009] By providing at least one flexible member having an engaging portion adapted to retain at least one gaseous vibration damping material between the engaging portion and the surface of the handle, this provides the advantage of enabling the material of the flexible member to be chosen to have the optimum frictional properties to enable a user to maintain a grip on the tool, and the vibration damping material at the same time to have the optimum vibration damping properties, while at the same time enabling the gaseous vibration damping material of the handle assembly to be held in

position by means of a single layer of material, thus enabling the assembly to be manufactured at significantly less cost.

[00010] The assembly may further comprise at least one cover plate for location over the or each said flexible member in position on the surface of the handle.

[00011] At least one said cover plate may comprise a respective substantially rigid member having at least one respective aperture for enabling at least part of said engaging portion to protrude therethrough.

[00012] At least one said flexible member may define in use at least one compartment containing at least one said vibration damping material between the engaging means and the surface of the handle.

[00013] At least one said vibration reducing material may be air.

[00014] According to another aspect of the present invention, there is provided a tool comprising:

a housing;

a motor within the housing adapted to actuate an output member of the tool; and

a handle assembly as defined above.

[00015] Said engaging portion may have an outer surface including at least one material of higher coefficient of friction than the material of the housing of the tool.

[00016] A preferred embodiment of the invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings, in which:-

Figure 1A is a perspective view of part of a housing of a power tool embodying the present invention;

Figure 1B is perspective view showing an alternative arrangement of a power tool according to the first embodiment.

Figure 2 is an exploded perspective view of the partial housing of Figure 1;

Figures 3A to 3C are side cross-sectional views of three alternative forms of the handle, flexible sheet and securing plate of Figures 1 and 2.

Figure 4A is a side view of a housing of a power tool according to a second embodiment of the invention.

Figure 4B is a top view of the housing shown in Figure 4A.

Figure 5 is a perspective view of a housing of a power tool according to a third embodiment of the invention.

Figure 6A is a front view of a housing of a power tool according to a fourth embodiment of the invention.

Figure 6B is a side view of the housing of the power tool shown in Figure 6A.

[00017] Referring to Figures 1A and 2, a power tool 1 such as a drill or jigsaw comprises a housing 2 defining an aperture 3 bounded on one side thereof by a handle 4, the housing 2 containing a motor (not shown) for actuating an output member such as a drill bit or jigsaw blade (not shown).

[00018] The housing 1 is formed from a generally durable plastics material, as will be familiar to persons skilled in the art, and has a recessed portion 5 on a generally smooth upper surface of the handle 4, the recessed portion 5 being provided with a recess 6 containing an actuating switch (not shown) for turning the tool 1 on and off. The housing 2 is provided with ventilation apertures 7 at one end of the recessed portion 5 to allow cooling of the interior of the housing 2.

[00019] A flexible sheet 8, of thermoplastic elastomeric material such as a silicone rubber or a polypropylene and butadiene compound having a coefficient of friction higher than that of the material from which the housing 2 is made, is formed by means of a suitable method such as moulding. The sheet 8 has a periphery shaped to fit inside the periphery of recessed portion 5 to cover all of the recessed portion 5 except that part in which the ventilation apertures 7 are provided, and the flexible sheet 8 is provided with a through-aperture 9 to allow access to the actuating switch in recess 6. The flexible sheet 8 is also provided with a series of protrusions 10, each of which defines an air-filled chamber 16 between the sheet 8 and the upper surface of the handle 4 of the housing 2 when the sheet 8 is placed in position on the upper surface of the recessed portion 5. The flexible sheet 8 may be fixed in position on the housing 2 by means of a suitable welding technique such as heat staking and/or ultrasonic vibration, as will be familiar to persons skilled in the art.

[00020] A securing plate 11 of durable plastics material, such as the material from which the housing 2 is constructed, has an internal surface 12 corresponding generally to the external (i.e. upper) surface of the flexible sheet 8. The securing plate 11 is provided with a series of first apertures 13 for allowing the protrusions 10 of the sheet 8 to protrude therethrough when the plate 11 is mounted to the handle 4 to secure the flexible sheet 8 in place, a second aperture 14 co-operating with the aperture 9 to allow access to the actuating switch in recess 6, and a series of third apertures 15 cooperating with the ventilation apertures 7 in the housing 2.

[00021] Referring to Figure 3A, a flexible sheet 8, having protrusion 10, is sandwiched between securing plate 11 and recessed portion 5 of handle 4. Protrusion 10 extends through first aperture 13 and along with recessed portion 5 of handle 4 defines air-filled chamber 16.

[00022] Referring to Figure 3B, in which parts common with the embodiment of 3A are denoted by like reference numerals increased by 100, protrusion 110 is provided with a plurality of resilient ribs 117 extending from an internal surface 118 of protrusion 110 to surface 119 of recessed portion 105. Ribs 117 provide an additional damping by their own resilience and/or by the formation of pockets of air within the air filled chamber 116. Ribs 117 may be formed into a pattern such as parallel lines or concentric rings.

[00023] Referring to Figure 3C, in which parts common with the embodiment of 3A are denoted by like reference numerals increased by 200, flexible sheet 208 is moulded so as to bond, at junction 220, with securing plate 211. As a result recessed portion 205 is in direct contact with securing plate 211. Ribs of the type shown in Figure 3B may also be included. Sheet 208 and securing plate 211 may be bonded to each other by an over-moulding operation or by the sheet 208 being formed in the second shot in a twin shot injection moulding process.

[00024] The operation of the handle 4 of the tool 1 of the invention will now be described.

[00025] When a user's hand (not shown) grips the tool 1 when in use, the user's hand comes into contact with the securing plate 11 and the protrusions 10 beneath which the air filled chambers 16 are located. As a result, vibrations generated by the motor in the tool housing 2 are damped by the air-filled chambers 16 beneath protrusions 10, and the user's grip on the tool is maintained by contact between the user's hand and the high friction material of the flexible sheet 8. It can therefore be seen that by suitable choice of material of the flexible sheet 8, the frictional properties of the sheet 8 can be optimised, while the vibration damping properties of the air-filled chambers 16 are generally superior to the vibration damping properties of known high friction materials used in conventional handle assemblies.

[00026] Figure 1B shows an alternative embodiment of the handle shown in Figure 1A, in which three protrusions 10', each defining an air-filled chamber with a surface of the handle, are disposed on the forward part of handle 4. A single oval shaped protrusion 10' defining an air-filled chamber is disposed on the rearward part of the handle. In this latter embodiment, with respect to the forward part of handle 4, the rearward and forward protrusion 10' are generally half-moon shaped and may have a dimension in the longitudinal direction of the handle of 15mm at the maximum region (along the center of the handle) and a maximum transverse width of 23.5mm (along the flat edge.) The thickness of each protrusion 22 may be 12mm. The middle protrusion 10' may have a dimension in the longitudinal direction of 15mm and has a transverse width of 30mm and thickness of 14mm. The exposed region of the housing between the protrusions may have a dimension of 8mm in the longitudinal direction, and the openings of securing plate 11 may have dimensions corresponding to that of the protrusions protruding therethrough. The housing at the location of middle protrusion 10' may have a maximum transverse width of 65mm. Protrusion 10' on the rear handle portion may have a longitudinal dimension of 65 mm, a transverse width of 20mm and a thickness of 17mm. The transverse width of the rear handle portion may be 35mm and the longitudinal dimension between the rear end of protrusion 10' and the end of the rear handle portion may be 38mm. In each case, protrusion 10' may protrude outwardly from the surface of the securing plate for a distance of approximately 2.5mm at the outer boundary of each protrusion 10' increasing to a distance of approximately 5mm near the center of each protrusion 10'.

[00027] Referring to Figures 4A to 4B, in which parts common to the embodiment of Figures 1 and 2 are denoted by like reference numerals but increased by 100, a handle 104 of a power tool 101 of a second embodiment of the invention, for example a sander, is shown. Protrusion 110 protruding

through a top surface is oval and may have a maximum longitudinal dimension along the centerline of the top surface of 80mm, a transverse width of 52mm and a thickness of 16mm. Protrusion 110 encloses an air-filled chamber and may be retained by an inner surface of the housing without a securing plate. Protrusion 110 may protrude outwardly from the surface of the housing for a distance of approximately 2.5mm at the outer boundary increasing to a distance of approximately 5mm near the center of the protrusion. The maximum transverse width of the handle may be 77mm.

[00028] Referring to Figure 5 in which parts common to the embodiment of Figures 4A and 4B are denoted by like reference numerals but increased by 100, a handle 204 of a power tool 201 of a third embodiment of the invention, for example a saw is shown. The saw includes a housing having a motor for reciprocating a drive shaft (not shown) to which saw blade 230 is attached to extend from a forward end. Opening 203 extends through the housing to form vertically extending rear handle portion 204A. Three protrusions 210 enclosing air-filled chambers extend outwardly from the rear surface of rear handle portion 204A. In a preferred embodiment, each protrusion 210 may have a longitudinal dimension (along the vertical length of the rear handle) of 26mm and a transverse width of 17.5mm, and a thickness of 9mm. The spacing between each protrusion 210 may be 5mm. Securing plate 211 has three apertures through which protrusions 210 protrude. Each opening may have a longitudinal dimension of 27mm and a transverse width of 18mm and the spacing between each opening may be 6mm.

[00029] Forward handle portion 204B is disposed generally forwardly of the motor and sloped downwardly towards the blade. Protrusion 210 extends outwardly from forward handle portion 904B. In a preferred embodiment, this protrusion 210 has a vertical length along the slope of 60mm, a transverse width of 30mm and a thickness of 20mm. The opening of the housing also may have a vertical length along the slope of 60mm and a

transverse width of 30mm. In each case, protrusion 210 may extend outwardly from the surface of the housing for a distance of approximately 2.5mm at the outer boundary of each protrusion increasing to a distance of approximately 5mm near the center of each protrusion 210.

[00030] Referring to Figures 6A and 6B, in which parts common to the embodiment of Figure 5 are denoted by like reference numerals but increased by 100, a handle 304 of a power tool 301 of a fourth embodiment of the invention, for example a drill, is defined by two halves 302A, 302B of housing 302. Each half 302A and 302B defines a recessed portion which accommodates three protrusions 310 defining air-filled chambers. Securing plates 311 of hard plastics material include screw bosses (unnumbered) and are secured to each housing half at the location of the recessed portions. Each securing plate 311 includes an appropriate aperture though which a protrusion 310 extends. Securing plates 311 are curved so as to substantially match the outer surface of the corresponding housing halves lateral of the protrusions, with the securing plates 311 and the corresponding housing half merging to form a substantially curved outer surface from which the protrusions extend. The outer surfaces of the protrusions may be curved as well.

[00031] With reference to Figure 6B, in one embodiment the dimension of the middle and lower protrusion 310 at their greatest extent in the longitudinal direction of the handle may be 17mm, while for the upper protrusion 310 the dimension may be 16mm. The distance between protrusions 310 in the longitudinal direction may be 5mm. The dimension of the upper and lower protrusion 310 at their greatest extent in the transverse direction of the handle may be 20 mm while for the middle protrusion 310 the transverse dimension may be 23 mm. The openings in securing plates 311 have dimensions corresponding to those of protrusions 310, while the overall dimension of securing plates 311 may be 75mm in the longitudinal direction

and 33mm in the transverse direction. As measured in a vertical direction, the overall distance from the upper edge of securing plates 311 to the lower edge may be 70mm, the overall distance from the upper edge of the uppermost protrusion 310 to the lower edge of the lowermost protrusion 310 may be 58mm, and in the horizontal direction the overall distance from the left edge of the lowermost protrusion 310 to the right edge of the uppermost protrusion 310 may be 30mm. Protrusions 310 may project outwardly from securing plates 311 by 2.5mm.

[00032] It will be appreciated skilled in the art that the above embodiment has been described by way of example only, and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.